NAS 1.46:18/8,9
DOCUMENTS

NASA Activities

National
Aeronautics and
Space
Administration

Fall 1987
Vol. 18, No. 8 & 9

VERSITY

U. S. Depository Document

About the Cover

The cover photo shows the inlet for the new, low-speed centrifugal compressor facility at NASA's Lewis Research Center, Cleveland, Ohio. The inlet is filled with 106,000 ordinary soda straws that straighten the air flow through the compressor. The inexpensive straws are thin, lightweight and provide minimal blockage. The purpose of the facility is to obtain "benchmark" experimental data for internal flow code verification and modeling to improve the performance of small centrifugal compressors used in helicopter engines and other low-power applications.

Contents

Administrator's Column 3
Space Station Hosts Robotics Demonstration 4
Dr. Noel Hinners: His New Roles 6
Shuttle Imaging Radar Uncovers Earth's Past 6
First NASA Mail Managers Conference 8
Assistant Administrator Isaac Gillam Retires 9
Exploring Our Solar System 10
Perry's Performance Pays 11
NASA Saves Candy 12
Did You Know? 13
NASA Wins Emmy 13
Contractor News 14

NASA Activities is published bimonthly by the National Aeronautics and Space Administration for the information of the agency's employees. Contributions and recommendations are solicited from headquarters and field centers and should be addressed to editor, NASA Activities, News and Information Branch, Code LM, Washington, D.C. 20546.

NASA Activities is distributed free of charge only to agency employees. This publication is available by subscription from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Check or money order should be made payable to Superintendent of Documents, GPO. Subscription rates are $8.00/year, domestic; $10.00/year, foreign.

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NAS 1.46:18/8,9

Administrator's Column

(The following is a speech given by NASA Administrator Dr. James C. Fletcher. This speech focuses on economic competitiveness . Dr. Fletcher's speech was presented on September 24, 1987, at the Commonwealth Club of California.)

Here in California and around the nation, Americans are facing up to the fact that we no longer can take our competitive edge for granted. Other nations have passed us by, or are in the process of doing so in basic industries, in manufactured goods, and even in high technology, which we once considered our own special domain. If we were to continue to let this happen, our economy and our standard of living would erode and it would be only a matter of time before the United States would become noncompetitive across the board.

So it's good news that we have finally decided to address the problem head-on. The President's competitiveness initiative, the growing emphasis on productivity, the quest for superior products and processes—all are vital thrusts if we are to maintain a growing and prosperous economy.

You may well ask why the Administrator of NASA would come all the way to California to begin a talk with words about economic competitiveness. Is there a connection between what NASA does and what it takes to keep the American economy on the competitive edge?

You bet there is. The connection between a strong science and technology base and a growing and prosperous economy may be hard to measure; but it is not possible to question. Let me explain why.

NASA marked its 29th anniversary on October 1, 1958, the year President Eisenhower signed into law the act that created NASA.

The National Aeronautics and Space Act charged the agency with objectives that include "the expansion of human knowledge in the atmosphere and space" and "the preservation of the United States as a leader in aeronautics and space-related science and technology." Working in partnership with American industry and universities, NASA set out to carry out that charge and succeeded.

We have landed 12 Americans on the Moon, explored the solar system with spacecraft and built a reusable Space Shuttle, a craft unique in the world. We developed satellites—for communication, for navigation, for meteorology, for search and rescue and for Earth sensing—that are of enormous benefit to mankind.

We helped to advance America's scientific and technological frontiers to learn more about Earth and its place in the Universe than in any other period in history. By pushing to keep American technology on the cutting edge, and by working to ensure that industry and all of society benefit from its research, NASA remains a vital spur to economic growth and prosperity.

The revolutions in communications technology, Earth sensing, solid state electronics, medical electronics and a host of other new fields all have come about as a result of NASA's work.

New industries, new products and new jobs all stem from the strong research and technological base that NASA has helped to develop. By pushing technological advance, innovation and productivity growth, NASA has been a vital element in maintaining America's economic strength and vitality.

Throughout its existence, NASA has spent on the order of $116 billion, or about one-third of what the Defense Department is spending only this year. That works out to a total of $518 dollars for every American living today, or about $19 a person per year.

Through the years, the NASA budget has averaged out to less than eight-tenths of one percent of the entire Federal Budget; that's a small price to pay, given the returns to the economy in direct applications and spin-offs of aerospace research. It has been estimated that more than 30,000 applications and spin-offs of NASA-developed technology—ranging from programmable heart pacemakers to laser surgery techniques—have flowed into our economy to meet people's needs on Earth.

In fact, in studies made of the Apollo program (which accounted for about one-fourth of NASA's total expenditures over the years) the economic return alone in spin-off products and processes was estimated at five to seven times the national investment.

So, scientific and technological advances, new jobs, new industries and new products and processes clearly are major NASA contributions to our national competitive thrust.

But there are other less tangible, but equally important consequences of NASA's work.

One is the spur to excellence that the space program gives to our young people. It is important that

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American youngsters continually be challenged to ensure that innovation and creativity continue to flow into our economy. These ingredients are key to national productivity and competitiveness.

Then there is the fact that the space program is unique among government programs, in that it serves as a visible measure by which we Americans judge ourselves and by which the rest of the world judges us.

When the program is down, the United States role in the world appears to be diminished—in our own eyes and in the eyes of the rest of the world. But when the program is up and flourishing—when we do things that no other nation can do or even attempt to do—that's when American pride at home and prestige abroad soars to new heights.

We saw this with the Apollo lunar landing program, with the 24 successful Space Shuttle Missions and with the triumphs of our unmanned spacecraft as they relayed the mysteries of the solar system into our living room TV sets. And we will see it again, as we go on to build a Space Station to give us a permanent base in space; an aerospace plane that eventually will cut flying time between Washington to Tokyo to under two hours; and even more sophisticated spacecraft to explore the solar system and the universe.

Like no other programs, the space program mirrors America—our hopes, our ideals, our restlessness and inquiring pioneering spirit. "There is no end to the potential of space," said President Reagan. And he is right.

Space Station Hosts Robotics Demonstrations As Part of AIAA Conference

On June 22, 23, and 24, approximately 1000 people witnessed the first display of advanced robotic systems technology being evaluated for use on the Space Station. These demonstrations, held at NASA's Goddard Space Flight Center, Greenbelt, Md., were part of a tour presented in conjunction with the American Institute of Aeronautics and Astronautics Space Station Conference. A total of eight demonstrations were actually held; two were staged for AIAA members, one for Goddard management, and five for Goddard employees and the general public.

"The technologies presented reflected the current state of the art, not only in terms of robot design, but in robot systems and control as well. It is our job to ensure that NASA's Space Station program can make maximum possible use of these and other new technologies for the purposes of assembly and servicing of the Station and any visiting spacecraft," commented David Provost, Manager of the Goddard Robotics Lab where the demonstration was held.

Demonstration crowds take close look at robotics technology.

The demonstrations were arranged into four separate stations, with each station addressing different modes of robot/human interaction:

STATION 1:

The Satellite Servicing Station, an effort of Central Research Labs, showed the use of a commercial remote manipulator system to perform repairs on a mockup of the Solar MAX satellite. Using remote manipulators like those employed in the nuclear industry, a human operator performed intricate tasks in an unstructured and hostile environment through "teleoperation".

STATION 2:

The National Bureau of Standards, a partner with Goddard Space Flight Center in the Space Station robotics effort, demonstrated a satellite docking scenario using an "autonomous" mode of control. The station used one robot to move a target identified by four light emitting diodes (LEDS), and a second robot, under its own autonomous control and guided by an infrared camera system to track the moving target and perform a docking manuever.

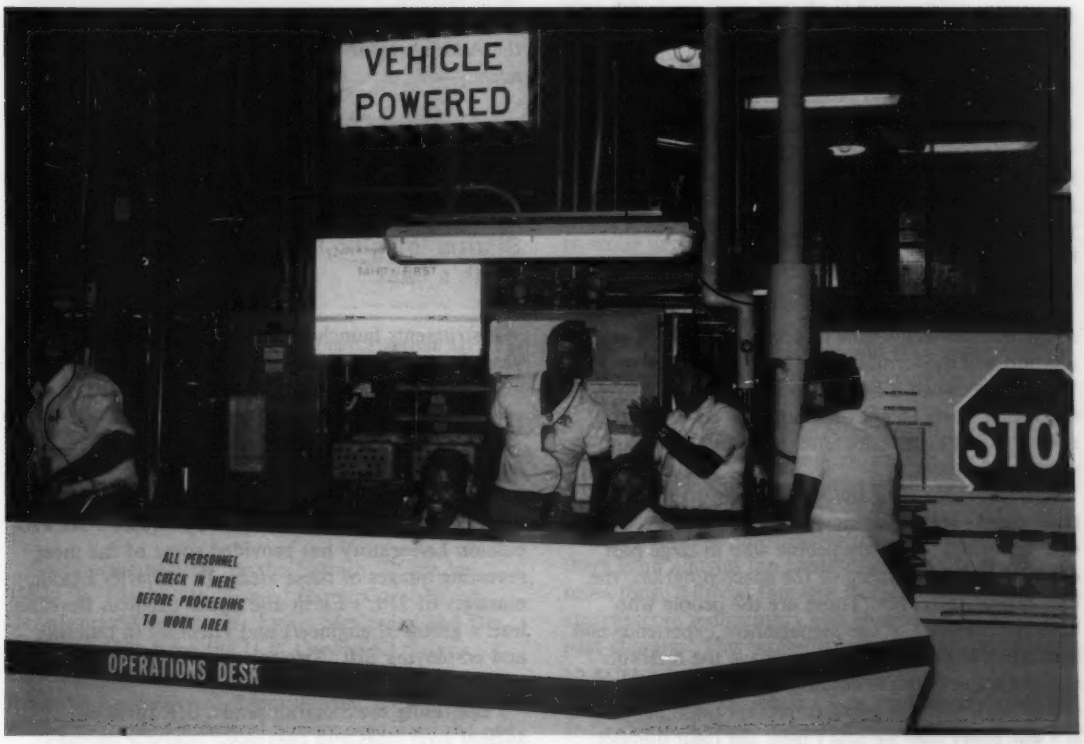
STATION 3:

A Space Station Mockup, an effort of the Goddard Robotics Laboratory, illustrated the use of a computer to share control of a robot with a human operator in autonomous or teleoperated mode. Operating on Space Station structures such as the Platform Interface Adapter (PIA) this station also incorporated the use of computer graphics to simulate and plan robot actions and the use of a fiber-optics "Star Bus" for communications at the rate of 100 million bits of information per second.

STATION 4:

The Orbital Replacement Unit Changeout Station reflected work performed by the Advanced Technology Laboratory at GE/RCA. The system demonstrated a number of modes of human interaction with robots including voice command recognition, shared control, teleoperation and autonomous operation. The demonstration used a PUMA robot to illustrate the use of these combined modes for ease of control. With this system, a single operator guides the system through a complex procedure using voice commands and joystick control while receiving spoken feedback from the robot control system which performs mixed mode control.

The major challenge in this program is how to integrate many diverse technologies, all of which are evolving at an accelerated rate. The evolution of robotic technology, demonstrated at Goddard has grown from the realm of human control or machine control to a stage where both humans and machines participate for greater efficiency, flexibility, and safety. The demands presented by the task of building and maintaining the Space Station require an acceleration of this evolution. The integration of technologies demonstrated in the Goddard Robotics Laboratory is a step on this path.



Smiles and applause emananted from the Orbiter Processing Facility at the Kennedy Space Center, Fl., when the Space Shuttle Discovery was powered up on August 3 to support processing for launch in June 1988. Faces glowed with joy and the once-dark "vehicle powered" sign glowed with energy.

Dr. Noel Hinners: His New Roles

In response to recommendations of the NASA Management Study Group, Associate Deputy Administrator (Institution) Dr. Noel Hinners will assist the Administrator and Deputy Administrator in the management of institutional matters at NASA Headquarters.

"What General Phillips and his study group found was that many of the agency people, especially its managers, believe that what we call the NASA institution—our people, our facilities, our equipment—have been increasingly neglected over the past five to 10 years," said Dr. Hinners.

Dr. Hinners will serve as an advocate for the institution so that institutional concerns will be given the time and attention that program concerns would receive, especially when the budget process is at work. "So that is the real top-level need and how the office came about," he said.

"Dr. Fletcher wanted somebody for this job who knows the centers and Headquarters, because the success in it is very dependent on understanding both roles—Headquarters and field center. Knowing the people, having the trust and confidence of the people in both places, that I'm here to help them get the job done and not be just another level of concurrence or signature sheet or review imposed on them," Hinners said.

The equipment and facilities installed 25 years ago at the new centers is now in desperate need of rehabilitation and modernization, Dr. Hinners explained. "If you've owned a house, you find that at 20 years the wiring starts to go, the plumbing goes, the roof needs redoing, the dishwasher gives out. The same with our facilities.

Moreover, many of the NASA scientific and technical people are becoming eligible to retire over the next few years. They are people who in large part came in at the beginning of the space program, the late '50s or early '60s. Those are the people who have the majority of the management experience and the technical experience. Do we have the reservoir and the trained people coming up through our system now who are going to replace these people? It's our belief that we don't have the right number of technical people and experience that we think we'll need for the future as we start into major programs such as the Space Staton, and enhanced aeronautics and science activity, he said.

Part of our process is to look at increased requirements for training, organizational development, career development, educational opportunities to insure that the technicians, scientists, engineers and managers of the future will have the kind of background that we think in the past has made the agency a viable place, a fun place, and technically exciting place to work.

One of the things that the culture study showed is that a very large proportion of the people in NASA do want to and intend to make a career of NASA. We have to be sure we create an environment which attracts and keeps good people in the agency. You've got to have good programs, good facilities and good organization. And it's by having good people, of course, that you have program success. That's the famous bottom line we're measured by success of our programs."

Not only is Dr. Hinners Associate Administrator for Institutions but he was recently appointed to serve as NASA Chief Scientist. As the NASA Chief Scientist, Dr. Hinners will be the principle advisor to the Administrator and to senior management on agency-wide aspects of NASA's scientific activities.

Shuttle Imaging Radar Uncovers Earth's Past

Instruments launched into orbit in the last few years have viewed Earth at wavelengths beyond the visible and provided some richly detailed and often surprising images of its surface.

Three areas in particular are being studied following analysis of the data produced by one of these instruments. Shuttle Imaging Radar (SIR), a synthetic aperture radar system developed by NASA's Jet Propulsion Laboratory has provided some of the most revealing images of these areas. Dr. Charles Elachi, manager of JPL's Earth and Space Sciences Division lead a group of engineers and scientists in building and employing SIR. Two missions have been flown, one in 1981 and one in 1984.

Penetrating the Saharan sands, SIR revealed ancient river beds and enormous drainage channels. In China, complex fracturing, fault lines and fluvial structures, enhanced under SIR's radar vision, may

yield clues to past, present and future continental drift and climatic changes. In Saudi Arabia, SIR data supports a hypothesis that an ancient and significant pre-Islamic city lies buried somewhere under dunes heaped over the course of abandoned caravan routes.

These areas all have climates characterized by aridity. This is the critical condition which permits radar to see through sand and soil to reveal a surface just beneath. Other restrictive conditions also apply. When the moisture level exceeds about one-percent, the radar sees only the surface, not the subsurface.

In the Sahara, it may rain only about once every 50 years in a given locality. SIR waves can penetrate such a sand layer for several meters.

The initial discovery of SIR's ability to penetrate Earth's immediate surface came as a surprise to researchers and led to an expedition to the Sahara to confirm these findings.

Egyptian workers dig in the feverish heat of the Saharan day while expedition scientists photograph. The diggers were concerned that the heat had impaired their employers' minds, until Dr. Elachi, who could speak Arabic, explained what they were searching for.

Seven scientists left for the Eastern Sahara in 1982; Dr. Elachi, Dr. Ronald Blom, Carol Breed, Dr. Maurice Grolier, Dr. James McCauley and Dr. Gerry Schaber from the U.S. Geological Survey (USGS), and an anthropologist, Dr. Bill McHugh, from the University of Pennsylvania.

The Egyptian Geological Survey organized the expedition — providing six jeeps, two trucks, tents, food, water and everything they would need for two weeks in one of the most barren places on Earth.

Within two weeks the team found what they were looking for — evidence that SIR had seen through the sand surface and imaged an older landscape, now buried. The Saharan sand sheet in the area under investigation is very smooth and therefore should have appeared dark on the radar. Instead it appeared as bright as the rough exposed limestone nearby. When the team's Egyptian workers dug through the sand, they hit limestone. This convinced the scientists that the radar was penetrating the sand and reflecting off the limestone bedrock underneath.

Further digs uncovered waterworn pebbles and boulders in what had appeared to be channels on the radar images. These findings helped convince the team that they had found tributaries to what may have been an enormous, but extinct, river system.

This ancient river system would have flowed southwest, to the Atlantic and would be a mirror image of the Amazon, draining what was in wetter times a water surplus from North Africa into the Atlantic. Confirmation of the "Trans-African drainage to the Atlantic" hypothesis awaits further SIR data and additional geological expeditions.

Meanwhile, the other two areas await primary investigation.

Scientists are negotiating with the Chinese to establish the parameters of an expedition to depart in 1988. If all goes well, JPL scientists, Dr. Diane Evans and Dr. Tom Farr will work with the Chinese Center of Remote Sensing, Beijing, during an expedition to remote desert regions in Western China to study geological features.

In preparation for the trip, Dr. Evans and Dr. Farr have been studying similar features in U.S. deserts. They hope to better understand features which record climatic change and thus understand better what has occurred and is occurring in Western China.

It is known that even as recently as 1,000 years ago, the area was much wetter. Part of the region under study is along silk routes which were open and active at that time.

A key area lies northeast of the silk route where there is an alluvial fan some 20 miles wide and 20 miles long. Alluvial fans are studied because they can preserve sedimentary and chemical evidence of past climates. This largest of alluvial fans promises an extraordinary harvest of data.

In the Lhase Region, an area immediately north of India, vertical faults enhanced by SIR data reinforce convictions that this portion of China is being driven east towards the Pacific Ocean.

Data from these investigations will assist National Geological reporter and photographer, How Mon Wong, who will travel the silk route and study the area.

Another individual seeking answers about a fascinating area is Nicholas Clapp, freelance film producer, Emmy Award winner and former Executive Producer for National Geographic Television.

Clapp is searching for the lost city of Ubar, or the Omanum Emporium as he believes it may also be called. Legends, historical documents and now SIR data are confirming Clapp's conviction that an important city lies buried under the sands of the empty quarter of the Saudi Arabian peninsula.

If discovered, according to Clapp, the city could yield an invaluable record of structures, inscriptions and artifacts from ancient southern Arabian culture.

First NASA Mail Managers Conference

The first NASA Mail Managers Conference was held on May 12-14, 1987 with fourteen attendees from the centers and mailing contractors participating. NASA spends approximately $4.5 million on postage each year. The conference provided an opportunity for the centers to share ideas and resolve issues toward a more efficient and cost effective mail management program.

A US Postal Service representative spoke on the new procedures for contractor mailing and cost accounting codes. There were several mail topics discussed which resulted in immediate accomplishments.

The conference was planned, coordinated and conducted by Mary Anne Stoutsenberger, Chief, Administrative Services, Headquarters Administration Division and Bessie Berry, NASA Assistant Mail Manager, Headquarters.

Attendees of the conference were: (First row left to right) Doris Grosshauser, Johnson Space Center; Colleen Holt, Lewis Research Center; Bessie Berry, NASA Headquarters; Carol Baker, Goddard Space Flight Center; Gary Smith, Marshall Space Flight Center; John McCaig, Jet Propulsion Laboratory; Mary Anne Stoutsenberger, NASA Headquarters; Tina Ballas, Rockwell; (Kneeling) Barbara Newton, Langley Research Center; (Second row, left to right) Betty Harrison, Rocketdyne; Mark Walther, Goddard Space Flight Center; Katie Garcia, Ames Research Center; and Michael Bajorek, Lewis Research Center.

Assistant Administrator Isaac Gillam Retires From NASA

Isaac T. Gillam IV, NASA Assistant Administrator for Commercial Programs, retired September 1 after a distinguished 34-year career of federal service.

Gillam was named to head NASA's newly created Office of Commercial Programs in September 1984 and led the agency's efforts to expand U.S. private sector investment and involvement in civil space-related activities.

"Ike Gillam has put in 25 faithful years at NASA. He's been a credit to the agency and is responsible for getting the commercial program started," NASA Administrator James C. Fletcher said. "We're sorry to see him go."

Prior to heading the Office of Commercial Programs, Gillam served as Assistant Associate Administrator in the Office of Space Flight, responsible for customer relations and policy.

He also served at NASA Headquarters as special Assistant to the NASA Administrator and participated in the establishment of national space policy under assignment to the White House Office of Science and Technology Policy.

From June 1978 to October 1981, he was the Director of NASA's Hugh L. Dryden Flight Research Center, the agency's major field center for flight testing high-speed aircraft and experimental vehicles, and landing site of the Space Shuttle Columbia. Prior to that, he was deputy director of the Center. In 1976, Gillam was appointed Director of Shuttle Operations at Dryden and served in that position during the approach and landing tests of the Space Shuttle Enterprise.

He joined NASA in 1963 as a program management specialist. In 1966, he was appointed assistant program manager for the Delta Launch Vehicle Program and in 1968, he became Delta Program Manager. In 1973, he was appointed program manager, Small Launch Vehicles and International Projects, which included the Delta and Scout launch vehicles and numerous international cooperative and reimbursable space projects with the European Space Agency, Italy, France, Germany, Japan, Indonesia, etc.

Born in Little Rock, Ark., Gillam graduated from Howard University, Washington, D.C., in 1953. Upon graduation, Gillam was commissioned a 2nd Lieutenant in the U.S. Air Force and served in Korea as a pilot. During his 10 years of service in the Air Force, he also served as a missile launch crew commander for the Strategic Air Command and as an assistant professor of air science in the Air Force ROTC program at Tennessee State University, where he pursued graduate studies.

Gillam is a member of Tau Beta Pi, a Fellow of the American Astronautical Society, an Associate Fellow of the American Institute of Aeronautics and Astronautics, a member of the Air Force Association, the National Defense Preparedness Association and the American Management Association.

He has received numerous citations and awards from government agencies and civic organizations. Among them are NASA's highest award, the Distinguished Service Medal, for his work on the Launch Vehicle Program, and two NASA Exceptional Service Medals. He was presented a 1981 Alumni Achievement Award from Howard University for his postgraduate achievements in the fields of space science and engineering, and Prairie View A&M University's Distinguished Professor of Engineering Service Award.

Gillam will long be remembered by NASA. He also will be remembered by many young adults inspired by his achievements. He truly served as one of NASA's foremost role models.

Gillam has accepted a position to work for OAO, Greenbelt, Md., an aerospace firm, following his retirement from federal service.

This year marks the 25th anniversary of the United States' first attempt to explore the other planets of our solar system. On July 22, 1962, an Atlas rocket with an Agena-B booster lifted Mariner 1, the first of a series of spacecraft designed for interplanetary investigation, off the launch pad at the Atlantic Missile Range at Cape Canaveral on what was intended to be a fly-by mission to Venus. These plans were temporarily dashed when a fault in the guidance control system caused the Atlas rocket to veer off course, obligating the range safety officer to order the rocket's destruction. But the march into space resumed the following month when Marines 1's twin, Mariner 2, was successfully sent on its way to rendezvous with our Earth's nearest neighbor.

The history of the Mariner program in its beginning phases bears out the truth of the adage "where there's a will, there's a way." Ever since the launch of Sputnik in 1957 sent shock waves running through the country, American scientists and engineers had been seeking to demonstrate to a worried public that American skill and technology were at least commensurate with, if not superior to, that of the Soviet Union. By the summer of 1961, the U.S. was pushing hard to strengthen its position in the exploration of space and the near planets. Specifically, NASA had developed plans to launch four spacecraft in the 1250-pound class, code-named Mariner A and B, designed to investigate the enviroment of both Venus and Mars.

Thrust capability was the one area in which the U.S. trailed in the space race. It served to keep the U.S. one step behind in the highly visible arena of manned spaceflight, and problems in booster development nearly scuttled NASA's plans for the Mariner project. The original Mariner proposal called for the spacecraft to be launched by a vehicle consisting of a modified Atlas D first stage, and a new second-stage booster named Centaur, which was still being developed. It became clear by August that the Centaur could not be readied in time for the 1962 Venus launch period, and existing rockets hadn't the capability to carry the Mariner A craft. Reluctantly, the decision was made to cancel the Mariner A portion of the program.

In order to keep the project alive, the Jet Propulsion Laboratory (JPL), which had design and development responsibility, recommended substantial revisions in the existing plans. It proposed replacing the Centaur upper stage with the Agena-B rocket, then in use for the Ranger lunar exploration series. But the weight of the Mariner spacecraft far exceeded the maximum payload which the Agena could thrust into a journey to Venus. The switch to a lower booster capacity necessitated a cut in the projected 1100-lb. payload of Mariner A to 450 lbs. Thus the spacecraft itself would have to be radically redesigned, with considerable trimming of its scientific apparatus. JPL's solution to this dilemma was the construction of a lightweight, hybrid spacecraft combining certain features of the Ranger 3 lunar explorer and the Mariner A original. The overall project was redesignated Mariner R.

Mariner gave us the first close-up view of our nearest neighbor.

Scientists and engineers were now faced with an arduous task. Within an 11-month period, on a schedule that could tolerate no delays, two spacecraft had to be developed, assembled, tested, and launched. In a virtuoso display of dedication and hard work, all major deadlines were met on time, concluding with the arrival of the equipment at Cape Canaveral and the subsequent launches on July 22 and August 27.

VIP Meeting

NASA Administrator Dr. James C. Fletcher conducted a briefing at the White House recently to update the President on NASA's plans and policies.

Seated at Table, Left to Right:
Secretary of Defense Caspar Weinberger, Vice President George Bush, President Ronald Reagan, Deputy Secretary of State John Whitehead, NASA Administrator Dr. James C. Fletcher, OMB Director James C. Miller III, National Security Advisor Frank Carlucci.

Perry's Performance Pays

Norm Perry, KSC's Industry Assistance Officer, recently received a special award from NASA Headquarters, "for his exemplary outreach efforts on behalf of small disadvantaged businesses at KSC."

Perry received a plaque accompanied by a letter from NASA officials.

"Mr. Perry has been conducting an extensive outreach program which has been recognized on a regional and national level. During the past five years, Mr. Perry has tremendously increased the stature and visibility of the NASA Industry Assistance Office at KSC," said Eugene Rosen, director of the Office of Small and Disadvantaged Business Utilization at Headquarters, in a letter to KSC Center Director Forrest McCartney.

One of the most notable accomplishments is Perry's initiative in forming the Brevard Small Business Assistance Council. The State Department of Commerce has been so impressed with the council's activities that it has been used as a role model to form other groups in the state.

In addition, Perry is commended for his involvement with the annual "Industry Briefing" at KSC and the Southern Technology Application Center seminars.

As a way of paying tribute to the exemplary out-

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reach efforts of Mr. Ferry, the Office of Small and Disadvantaged Business Utilization in a special presentation on May 14, 1987, awarded a plaque to Mr. Perry inscribed with the following:

In recognition of your outstanding support to the Brevard Small Business Assistance Council and your exceptional outreach efforts on behalf of Small and Small Disadvantaged Businesses at Kennedy Space Center

Below the plaque is presented to Mr. Perry (left) by Admiral Stuart J. Evans, Assistant Administrator for Procurement, NASA Headquarters.

"All of NASA can be proud of the extraordinary fine job Mr. Perry is performing to improve the health and progress of our nation's small business," Rosen said in the letter.

NASA Saves Candy

Heat pipe technology, which has been used extensively in space, has sweetened the energy diet of a candy manufacturer in Albany, Ga. Bobs Candies, the world's largest producer of candy canes, must produce the confections year-round to meet Christmas demand. The crisp, white, brightly striped canes must be stored at controlled temperature and humidity levels to retain product freshness. To reduce humidity, the company's warehouse air condititioners consume huge amounts of energy to "super cool" air to remove moisture and then reheat it to acceptable temperature.

For four years, Mukesh Khatter of the Florida Solar Energy Center has been adapting heat pipes for air-conditioning systems to efficiently increase their moisture removal capabilities. Heat pipes are very efficient air-to-air heat exchangers. When a heat pipe is placed between the cold outcoming and warm ingoing air streams of an air-conditioning system, it transfers heat from the warm to the cold air. The heat pipe boosts the system's precooling and dehumidification and provides free heating. The result is a very energy efficient system.

When Don Bravaldo, Bobs Candies VP, learned about Khatter's work under a technology transfer contract with NASA's Kennedy Space Center, Fl., he enlisted NASA's help to apply the technology. Georgia Power Company, which supplies energy to the candy manufacturer, joined the project to support this energy-saving effort and to learn more about this new technology.

A candy warehouse in Albany was selected to demonstrate the technology. The warehouse is used only during the summer months, and the air-conditioning equipment's energy consumption levels for the past four years were known. Existing system performance was monitored before retrofit. The heat pipes were installed in early 1987, and the results were phenomenal:

- In June 1987, the system used only 38,960 kWh at a cost of $3,312 compared to 152,160 kWh at $8,667 in June of 1985. That totals 74% in energy savings and 62% in dollar savings.
- The July 1987 results were even sweeter. The system used only 19,120 kWh costing $1,797, compared to 154,440 kWh at $8,683 in July of 1985. That represents 88% in energy savings and 79% in dollar savings.

The demonstration showed additional benefits; use of heat pipes increased the system's moisture removal capacity. Previously the warehouse had two 30-ton air-conditioning systems to meet space conditioning needs. Only one of the two units was retrofitted with heat pipes and it alone is now sufficient to maintain indoor conditions. In addition, indoor humidity levels are generally lower than in previous years.

Khatter explains that not all of the enormous energy savings are due to the heat pipe alone. About half of the savings came from proper system integration and controls.

There are numerous applications where the use of this technology can greatly reduce energy expense. Examples include any situation where reheating is used for humidity control—manufacturing and storage of drugs, chemicals, paper, chocolate and electronic components; drying of film, food products and lumber; and air conditioning of museums, auditoriums, grocery stores, hospitals and clean rooms.

Did You Know?

The Army has initiated a new executive development program called the Intragovernmental Research Fellowship Program. The objective of this program is to expose high-potential, highly-screened Lt. Colonels to civilian organizational climates and management processes through a 1-year assignment in a federal agency. Two of these Fellows were assigned to NASA on August 17, 1987.

Lt. Colonel Palmer Penny (top) will be program manager, Flight Research and Technology and will be responsible for aircraft systems flight programs such as RSRA/X-Wing and Rotocraft Technology in the Flight Projects Division, NASA Headquarters.

In addition to a variety of Army assignments in staff, command, research and operation, Colonel Penny is an aviator, holds a BS from West Point, an MS in aero engineering from University of Washington and has taught engineering courses at West Point.

Lt. Colonel Dennis Moen will be a Program Manager for one of the engineering Space Station flight projects in the Shuttle Payload Engineering Division, in the Office of Space Science Application, NASA Headquarters.

In addition to a variety of Army assignments in staff, command, research and operation, Colonel Moen has specialty in communications engineering, holds a BS degree from West Point, and an MS in electrical engineering from University of Arizona.

On September 16, Dr. John M. Klineberg, Director of NASA's Lewis Research Center (LeRC), attended the National Academy of Television Arts and Sciences' awards ceremony in New York where NASA was presented an Emmy for developing technology which ultimately improved television broadcasting throughout the world.

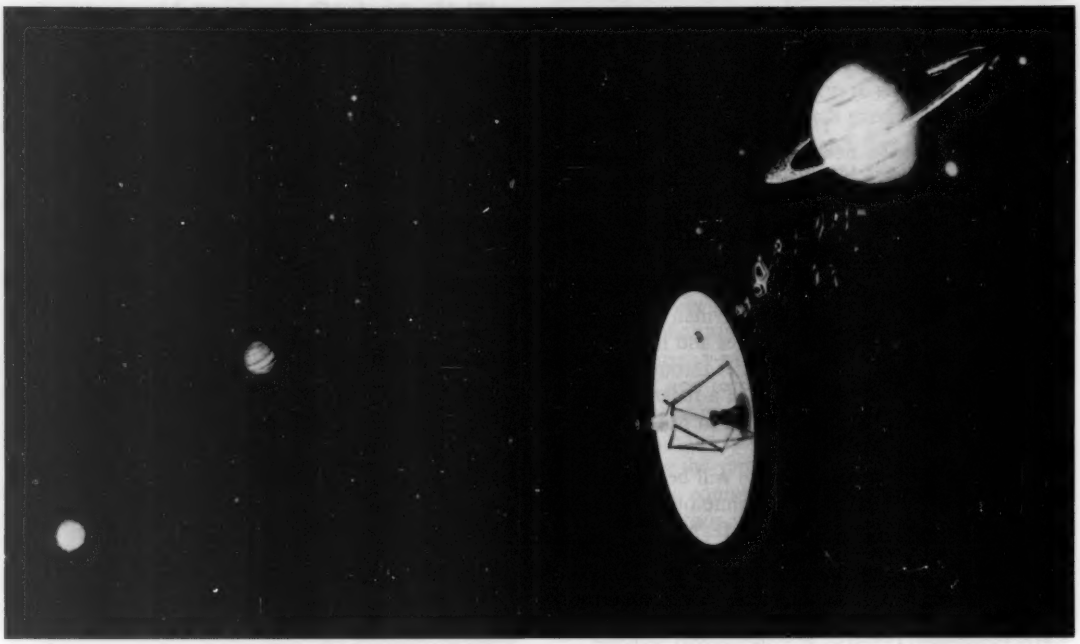
The Emmy, for Outstanding Achievement in the Science of Television Engineering, was presented to NASA for its work on the Communications Technology Satellite (CTS) project.

Launched in 1976, the CTS was the first communications satellite to incorporate use of a high-efficiency, high-powered transmitting tube invented by NASA's Lewis Research Center. This tube made it possible for the CTS to operate at power levels 10 to 20 times higher than those of that era, and in a new frequency band—the Ku band—allocated for broadcast satellites. This higher broadcast capability made it possible to use much smaller and far less expensive ground receiving equipment than ever before. It also enabled transmission to remote areas where terrestrial communications are not highly developed.

Many domestic and foreign communications satellites in operation today are using the technology first demonstrated by the CTS.

The CTS was a joint project between the United States and Canadian governments. LeRC was responsible for the U.S. portion of the project which included development of the high-powered transmitter tube for the spacecraft, environmental testing, providing the launch vehicle, and launch services. The spacecraft itself was developed by the Communications Research Centre in Ottawa, Canada.

NASA Administrator Dr. James C. Fletcher is presented the Emmy by Dr. Edward Miller, Chief of Lewis Research Center's Communication System Branch.



With one spacecraft enroute to distant Neptune and the other exploring the outer solar system, the Voyager mission celebrated its 10th anniversary of launch on Aug. 20.

Voyagers 1 and 2 have logged billions of miles over the past decade, executing flybys of the giant planets Jupiter, Saturn and Uranus. The two unmanned craft have relayed a staggering amount of data on each of the planetary systems, in the process discovering such phenomena as new moons, rings and the first active volcano in space.

After Voyager 2's encounter with Neptune in August 1989, the two spacecraft will continue out of the solar system in search of the heliopause, the outer boundry of the sun's energy influence.

Contractor News

NASA's Lewis Research Center, Cleveland, awarded a $32,104,920 contract to **The Garrett Corporation, Garrett Turbine Engine Company,** Phoenix, Ariz. Under the contract Garrett will develop and demonstrate technologies of structural ceramic components with potential for 3500 hours of operation in a turbine engine environment at up to 2500 degrees F.

According to the 5-year, cost-sharing contract, Garrett's share is $6,420,984, and the government's is $25,683,936. Work will be performed at the contractor's plant.

The new Advanced Turbine Technology Applications Project (ATTAP) contract will support the Department of Energy's (DOE) Automotive Gas Turbine Program. The project is funded by the DOE with technical and contract management provided by the NASA Lewis Research Center.

Ceramic technology developed in ATTAP will be applied directly to automotive type turbine engines with spin-off to hot-flow path turbine engine components for non-automotive applications.

NASA's Ames Research Center, Mountain View, Calif., selected **Cray Research, Inc.**, Minneapolis, Minn., and **ETA Systems, Inc.**, St. Paul, Minn., for final negotiations leading to award of contracts for acquisition of initial systems for the high speed processor-2 (HSP-2) computer system for use in the numerical aerodynamic simulation processing system network.

This acquisition will procure two initial prototype computer systems. After testing and evaluation, one will be upgraded to meet the full HSP-2 requirements. In this acquisition, two 4-year firm-fixed price contracts (with 1 base year and 3-year options period) are anticipated. The dollar value for the two initial systems is approximately $14 million. The total dollar value for acquisition of the initial

systems and the option for one HSP-2 system is approximately $45 million.

The acquisition consists of two phases: 1) lease of an initial system for one 12-month basic period, and 2) an option for lease of the HSP-2 system, which will replace the initial system, for one 36 month period.

The initial system will be capable of performance exceeding 250 million floating-point operations per second in sustained computation with at least 500 million bytes of common memory and at least 25 billion bytes of high-speed mass storage. The HSP-2 system will be capable of performance exceeding 1 billion floating-point operations per second in sustained computation with at least 2 billion bytes of common memory and at least 50 billion bytes of high-speed mass storage.

The work will be performed at Ames Research Center. This contract is scheduled to begin Nov. 1, 1987.

NASA-Ames Research Center, Mountain View, Calif., selected **Applied Technology Center, Northrop Services, Inc.,** (NSI), Sunnyvale, Calif., for final negotiations leading to the award of a cost-plus-fixed-fee contract. The 5-year contract has a proposed value of approximately $11 million.

NSI will provide management and administrative support, engineering, technical, logistical, administrative and clerical services to support the operation, maintenance, modification and research activities of the Man-Vehicle Systems Research Facility (MVSRF) at Ames Research Center. This contract began Aug. 1, 1987.

NASA's Langley Research Center, Hampton, Va., selected **Wyle Laboratories**, Hampton, for negotiations of a contract to provide instrument support services.

The cost-plus-award-fee contract began Oct. 1. The basic 5-year contract is valued at $49 million. The contract includes options for additional hours and materials proposed at $9.5 million.

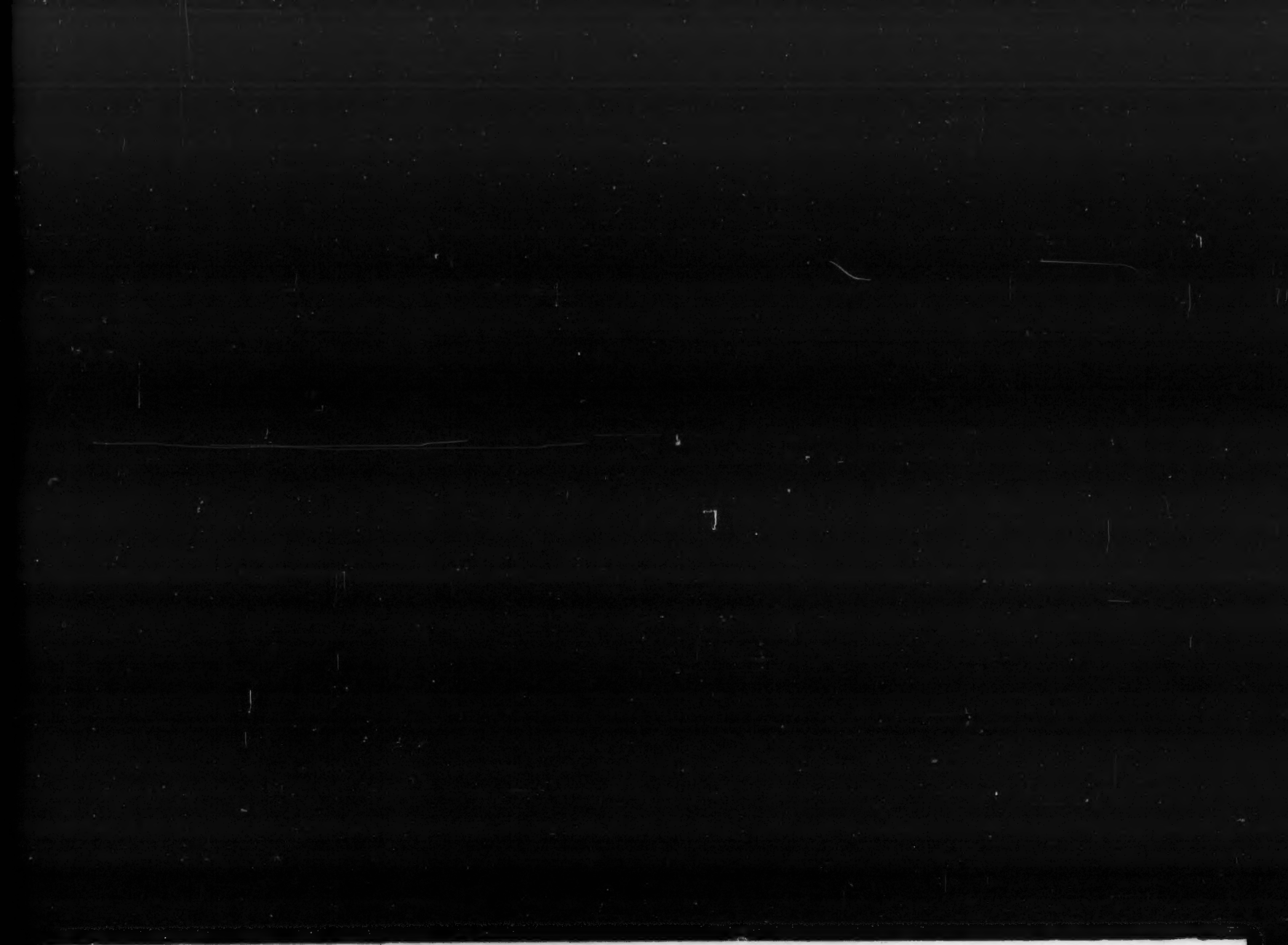
Wyle support services will include repair, calibration and maintenance of instruments and instrument systems; application of transducers; design and modification of data acquisition systems; preventive maintenance and on-site emergency repair; evaluation of measurement requirements, instruments and systems; analysis of measurement data; documentation of test results; maintaining instrument service history records; providing a systematic preventative maintenance and calibration program on specified instruments and systems; operating an instrument loan pool; and inspection of new instruments purchased by the government.

The work will be accomplished at the Langley Research Center and the contractor's Hampton facility.

NASA's Goddard Space Flight Center, Greenbelt, Md., has selected **New Mexico State University's Physical Science Laboratory** at Las Cruces, New Mexico, to negotiate a contract for the operation and support of the National Scientific Balloon Facility and for engineering support of NASA's balloon program.

The contract, effective Oct. 1, consists of a 3-year basic with two 1-year hard options. Additionally, a separate fixed-price, phase-in contract of 45 days will be negotiated.

The estimated cost for the basic 3-year option period is valued at $26.1 million. Costs for the two hard 1-year options are placed at $9.5 and $9.9 million respectively.

The contract covers operational support and quality contract engineering at the National Scientific Balloon Facility, Palestine, Texas, and at remote sites around the world used by NASA to launch balloons, as well as for engineering analysis and development in advanced balloon systems at Goddard's Wallops Flight Facility, Wallops Island, Va. It also calls for the contractor to possess an in-house engineering development and fabrication capability separate from Wallops Flight Facility and the National Scientific Balloon Facility.

This is the STS-26 crew patch. The predominant themes are: a new beginning (sunrise), a safe mission (stylized launch and plume), the building upon the traditional strengths of NASA (the red vector which symbolizes aeronautics on the original NASA insignia), and a remembrance of their seven colleagues who died aboard Challenger (the seven-starred Big Dipper). The patch was designed by artist Stephen R. Hustvedt of Annapolis, Md. STS-26 crewmembers are Astronauts Frederick H. (Rick) Hauck, commander; Richard O. Covey, pilot; and George D. (Pinky) Nelson, John M. (Mike) Lounge and David C. Hilmers, mission specialists.